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Claims

What is claimed is:

1. A method for error reduction in a communication system comprising a plurality of communication devices and a plurality of orthogonal subcarriers, the method comprising steps of:

determining, by a first communication device of the plurality of communication devices, an equalization function that reduces a multipath delay of the received signal;

receiving, by a second communication device of the plurality of communication devices, subcarrier suppression information;

suppressing, by the second communication device, an orthogonal subcarrier of the plurality of orthogonal subcarriers based on the received subcarrier suppression information to produce a suppressed subcarrier and a non-suppressed subcarrier;

transmitting, by the second communication device, a signal comprising at least the non-suppressed subcarrier to produce a transmitted signal;

receiving, by the first communication device, the transmitted signal to produce a received signal; and

processing, by the first communication device, the received signal based on the determined equalization function.

2. The method of claim 1, further comprising steps of:

determining, by the first communication device, a signal quality metric for each subcarrier of the plurality of orthogonal subcarriers to produce a plurality of signal quality metrics;

transmitting, by the first communication device, subcarrier suppression information based on the plurality of signal quality metrics; and

wherein the subcarrier suppression information received by the second communication device comprises the subcarrier suppression information transmitted by the first communication device.

Delay = 1 = 16, 28
MATRICES = 12, 23, 26
375/260

1 = 23
12 = 26
16

3. The method of claim 2, further comprising a step of determining an order of the plurality of orthogonal subcarriers based on the determined signal quality metrics, and wherein the step of suppressing a subcarrier comprises a step of suppressing a subcarrier of the plurality of orthogonal subcarriers based on the determined order to produce at least one suppressed subcarrier and at least one non-suppressed subcarrier.

4. The method of claim 2, further comprising a step of comparing at least one determined signal quality metric to a signal quality metric threshold to produce a comparison, and wherein the step of suppressing a subcarrier comprises a step of suppressing an information bearing subcarrier of the plurality of information bearing subcarriers based on the comparison order to produce at least one suppressed subcarrier and at least one non-suppressed subcarrier.

5. The method of claim 1, further comprising a step of determining a quantity of orthogonal subcarriers for suppression in order to reduce a transmitted power level below a predetermined power level threshold, and wherein the step of suppressing an orthogonal subcarrier comprises a step of suppressing the determined quantity of orthogonal subcarriers to produce at least one suppressed subcarrier and at least one non-suppressed subcarrier.

6. The method of claim 1, wherein the step of determining an equalization function comprises steps of:

determining a channel transfer function;

determining a desired composite communication channel transfer function;

determining an equalization function based on the determined channel transfer function and the desired composite communication channel transfer function, wherein the equalization function reduces the multipath delay of the received signal when the multipath delay of the received signal exceeds a tolerable multipath delay.

7. The method of claim 6, wherein a convolution of the equalization function with the estimated channel transfer function produces a desired composite communication channel transfer function that comprises the tolerable multipath delay.

8. The method of claim 6, wherein the determined channel transfer function comprises a greater multipath delay than the tolerable multipath delay of the desired composite communication channel transfer function, and wherein the equalization function reduces a multipath delay of a received signal.

9. The method of claim 1, wherein the first communication device comprises a plurality of antennas, wherein the step of determining an equalization function comprises a step of determining, by a first communication device of the plurality of communication devices, a plurality of equalization functions that together reduce a multipath delay of the transmitted signal, wherein the step of receiving comprises a step of receiving, by the first communication device, the transmitted signal via each antenna of a plurality of antennas to produce a plurality of received signals, and wherein the step of processing comprises a step of processing, by the first communication device, each received signal of the plurality of received signals based on a determined equalization function of the plurality of determined equalization functions.

10. The method of claim 9, wherein the step of determining a plurality of equalization functions comprises steps of:

determining a plurality of composite equalization functions, wherein each composite equalization function of the plurality of composite equalization functions comprises a plurality of equalization functions that together reduce a multipath delay of the transmitted signal;

determining an optimal composite equalization function from among the plurality of composite equalization functions; and

determining a plurality of equalization functions based on the determination of an optimal composite equalization function.

11. The method of claim 10, wherein the step of determining an optimal composite equalization function comprises steps of:

for each composite equalization function of the plurality of composite equalization functions, determining a signal-to-noise ratio (SNR) for at least one subcarrier of a signal received by the first communication device to produce determined SNR's;

for each composite equalization function of the plurality of composite equalization functions, determining a minimum SNR from among the determined SNR's;

determining a maximum SNR from among the minimum SNR's determined for each composite equalization function of the plurality of composite equalization functions to produce a determined maximum SNR; and

determining an optimal composite equalization function based on the composite equalization function corresponding to the determined maximum SNR.

12. A method for error reduction in a communication system comprising a plurality of orthogonal subcarriers, the method comprising steps of:

determining a signal quality metric for each orthogonal subcarrier of the plurality of orthogonal subcarriers to produce a plurality of signal quality metrics; and Metrics

suppressing an orthogonal subcarrier of the plurality of orthogonal subcarriers based on a signal quality metric of the plurality of signal quality metrics.

13. The method of claim 12, wherein the step of suppressing an orthogonal subcarrier comprises steps of:

determining an order of the plurality of orthogonal subcarriers; and

suppressing an orthogonal subcarrier of the plurality of orthogonal subcarriers based on the determined order.

14. The method of claim 12, wherein the step of suppressing an orthogonal subcarrier comprises steps of:

comparing at least one signal quality metric of the plurality of signal quality metrics to a signal quality metric threshold to produce a comparison; and

suppressing an orthogonal subcarrier of the plurality of orthogonal subcarriers based on the comparison.

15. The method of claim 12, wherein the communication system further comprises a transmitting communication device that transmits user information and a receiving communication device that receives user information, wherein the step of determining a signal quality metric is performed by the receiving communication device, and wherein the step of suppressing a subcarrier is performed by the transmitting communication device.

16. A method for error reduction in an orthogonal modulation communication system comprising steps of:

delay

determining an equalization function that is capable of reducing a multipath delay of a received signal that comprises a plurality of orthogonal subcarriers; and

reducing a delay of the received signal based on the computed equalization function.

17. The method of claim 16, wherein the step of determining an equalization function comprises steps of:

determining a channel transfer function;

determining a desired composite communication channel transfer function; and

determining an equalization function that is based on the determined channel transfer function and the desired composite communication channel transfer function and that reduces a multipath delay of a received signal.

18. The method of claim 17, wherein a convolution of the equalization function with the estimated channel transfer function produces a desired composite communication channel transfer function that comprises a tolerable multipath delay.

19. The method of claim 17, wherein the determined channel transfer function comprises a greater multipath delay than the tolerable multipath delay of the desired composite communication channel transfer function.

20. The method of claim 17, wherein the step of determining an equalization function comprises a step of determining a plurality of equalization functions that are based on the determined channel transfer function and the desired composite communication channel transfer function that together reduce a multipath delay of the received signal.

21. The method of claim 20, wherein the step of determining a plurality of equalization functions comprises steps of:

determining a plurality of composite equalization functions, wherein each composite equalization function of the plurality of composite equalization functions comprises a plurality of equalization functions that together reduce a multipath delay of the received signal;

determining an optimal composite equalization function from among the plurality of composite equalization functions; and

determining a plurality of equalization functions based on the determination of an optimal composite equalization function.

22. The method of claim 21, wherein the step of determining an optimal composite equalization function comprises steps of:

for each composite equalization function of the plurality of composite equalization functions, determining a signal-to-noise ratio (SNR) for at least one subcarrier of an orthogonal frequency division multiplex signal to produce determined SNR's;

for each composite equalization function of the plurality of composite equalization functions, determining a minimum SNR from among the determined SNR's;

determining a maximum SNR from among the minimum SNR's determined for each composite equalization function of the plurality of composite equalization functions to produce a determined maximum SNR; and

determining an optimal composite equalization function based on the composite equalization function corresponding to the determined maximum SNR.

23. A communication device comprising:

a receiver that receives a signal that comprises a plurality of orthogonal subcarriers;

a signal processing unit coupled to the receiver that receives the plurality of orthogonal subcarriers from the receiver, determines a signal quality metric for each subcarrier of the plurality of orthogonal subcarriers, and determines subcarrier suppression information based on the determined signal quality metrics; and

a transmitter coupled to the signal processing unit that receives the subcarrier suppression information from the signal processing unit and transmits the received subcarrier suppression information.

24. The communication device of claim 23, wherein the subcarrier suppression information comprises the determined signal quality metrics.

25. The communication device of claim 23, further comprising a memory associated with the signal processing unit that stores a signal quality metric threshold, wherein the signal processing unit further retrieves the signal quality metric threshold from the memory and compares at least one determined signal quality metric to the signal quality metric threshold to produce a comparison, and wherein the subcarrier suppression information comprises the comparison.

26. In a communication system comprising an orthogonal modulation scheme wherein user information is modulated onto a plurality of orthogonal subcarriers, a communication device comprising:

a receiver that receives a signal comprising subcarrier suppression information, wherein the subcarrier suppression information is based on a plurality of signal quality metrics determined for each orthogonal subcarrier of the plurality of orthogonal subcarriers;

a signal processing unit coupled to the receiver that receives the subcarrier suppression information, suppresses at least one orthogonal subcarrier of the plurality of orthogonal subcarriers based on the subcarrier suppression information to produce a suppressed orthogonal subcarrier, receives data sourced by a data source, modulates the data onto a non-suppressed orthogonal subcarrier of the plurality of orthogonal subcarriers to produce a modulated non-suppressed orthogonal subcarrier; and

a transmitter coupled to the signal processing unit that transmits the modulated non-suppressed orthogonal subcarrier.

27. The communication device of claim 26, wherein the signal processing unit modulates the data onto each orthogonal subcarrier of the plurality of orthogonal subcarriers prior to suppressing the at least one orthogonal subcarrier.

28. In a communication system wherein a communication channel introduces multipath delay to a transmitted signal, a communication device comprising:

a receiver that receives a signal comprising a plurality of orthogonal subcarriers; and

a signal processing unit coupled to the receiver that determines a transfer function corresponding to the communication channel, determines an equalization function that is based on a determined communication channel transfer function and that reduces the multipath delay when the multipath delay exceeds a tolerable multipath delay, and processes the signal based on the determined equalization function.

29. The communication device of claim 28, wherein the determination of an equalization function by the signal processing unit comprises determining a desired composite communication channel transfer function and determining an equalization function based on the communication channel transfer function and the desired composite communication channel transfer function.

30. The communication device of claim 28, wherein the signal comprising a plurality of orthogonal subcarriers comprises a first signal, wherein the receiver further receives a second signal comprising a plurality of orthogonal subcarriers, wherein the signal processing unit determines subcarrier suppression information based on the plurality of orthogonal subcarriers included in the first signal and conveys the determined subcarrier suppression information to a transmitter coupled to the signal processing unit, and wherein the transmitter transmits the subcarrier suppression information.

31. The communication device of claim 28, wherein the communication device further comprises a plurality of antennas, wherein the reception by the receiver of a signal comprises receiving a transmitted signal via each antenna of the plurality of antennas to produce a plurality of received signals, wherein the transmitted signal comprises a plurality of orthogonal subcarriers, wherein a determination of an equalization function by the signal processing unit comprises a determination of

a plurality of equalization functions based on a determination of at least one communication channel transfer function, wherein the plurality of equalization functions together reduce a multipath delay of the transmitted signal when the multipath delay exceeds a tolerable multipath delay, and wherein a processing of the signal by the signal processing unit comprises processing each received signal based on a determined equalization function of the plurality of determined equalization functions.

32. The communication device of claim 31, wherein the determination of a plurality of equalization functions comprises determining a plurality of composite equalization functions, wherein each composite equalization function of the plurality of composite equalization functions comprises a plurality of equalization functions that together reduce a multipath delay of the transmitted signal, determining an optimal composite equalization function from among the plurality of composite equalization functions, and determining a plurality of equalization functions based on the determination of an optimal composite equalization function.

33. The communication device of claim 32, wherein the determination of an optimal composite equalization function comprises determining, for each composite equalization function of the plurality of composite equalization functions, a signal-to-noise ratio (SNR) for at least one subcarrier of a signal received by the communication device to produce determined SNR's, determining, for each composite equalization function of the plurality of composite equalization functions, a minimum SNR from among the determined SNR's, determining a maximum SNR from among the minimum SNR's determined for each composite equalization function of the plurality of composite equalization functions to produce a determined maximum SNR, and determining an optimal composite equalization function based on the composite equalization function corresponding to the determined maximum SNR.